

## Editorial



Dear Readers of CHIMIA

Metrology can be briefly defined as the science of measurement. In chemistry the items to be measured are atoms, molecules, ions or particles. The direct counting of the number of items in a sample is mostly impossible or at least not simple because of their generally enormous number.

In order to compare results from different samples in time and space we need common defined units and known standards for dissemination. Today the framework is given by the international system of units (SI) based on seven units. The custodian of the SI is the General Conference on Weights and Measures (CGPM), an intergovernmental body under the Meter Convention that was established already in 1875 by 17 signature member states. Today, fifty-two states have signed the convention, including all the major industrialised countries. The CGPM is advised by specific institutions and committees competent in the different fields of science. The advisory committee for the amount of substance and its unit mole is the Consultative Committee for the Quantity of Matter (CCQM).

The definition of a SI-base unit for amount of substance ‘the mole’ was introduced by the 14th General Conference only in 1971 as a the seventh unit of the SI. The mole allows the link between the macroscopic and the atomic or molecular world. In the wake of the possible new definition by 2011 by the CGPM of the unit for mass, the definition of the mole came under dispute as well. Two contributions with opposite opinions will argue for or against such a new definition. The reader should form his own opinion about it and he is welcome to address comments to the decision makers.

There are three main aspects of metrology in chemistry that are always in the focus of the metrologists: traceability, uncertainty of measurement value and the validation of measurement method. This is called the metrological tripod that forms a sound base for comparable measurement values. Traceability is vital as the link to the SI (or other references) by an unbroken chain of comparisons with corresponding uncertainties. The uncertainty of a measurement value (and not of a method) allows a proper judgement of a value. The limits of a measurement method have to be tested experimentally and will result in a statement about its validity. For sound and critical decisions based on measurement values all necessary work categorised by the metrological tripod are mandatory.

In 1993 a new guide to the expression of uncertainty in measurement was published and was supported by seven international bodies including IUPAC. It was a compromise solution after years of debate between experts. The Guide to the Expression of Uncertainty in Measurement (GUM) is accepted in all areas of measurement, but is not very much known by scientists outside the metrological community. It would be certainly worth for all of them to adopt the concepts of the GUM that help to understand and improve measurements. Since early 2009, this document is freely accessible on the web under: [http://www.bipm.org/utils/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf).

Additionally a guide for the evaluation of measurement uncertainty is offered by EURACHEM <http://www.eurachem.org/guides/QUAM2000-1.pdf>.

Selected experts in the field of chemical metrology were invited to report very generally and comprehensively about their field of expertise to the commonly non-metrology oriented readers of CHIMIA. Dr. Robert Kaarls, the president of the CCQM and his scientific secretary Dr. Robert Wielgosz, introduce the international metrological activities in the chemical field. Further metrologists from Austria, Belgium, England, Denmark, Germany, the Netherlands, the United States of America, Brazil and Switzerland who are mostly members of the national metrology institutes (NMIs) and therefore responsible for distributing traceable values in their countries report on tasks that are required by law or otherwise required. All authors are thanked for their valuable contributions, the reviewers for their critical comments and suggestions. It is to be hoped that you as a reader will get some valuable insight into the metrological aspects of chemical measurement science for the benefit of the society.

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It is with great pleasure that the Editorial Board of CHIMIA thanks the guest editor Dr. Samuel Wunderli for the successful realisation of this special issue on Metrology in Chemistry, a topic of fundamental importance to the field and one which is frequently overlooked.